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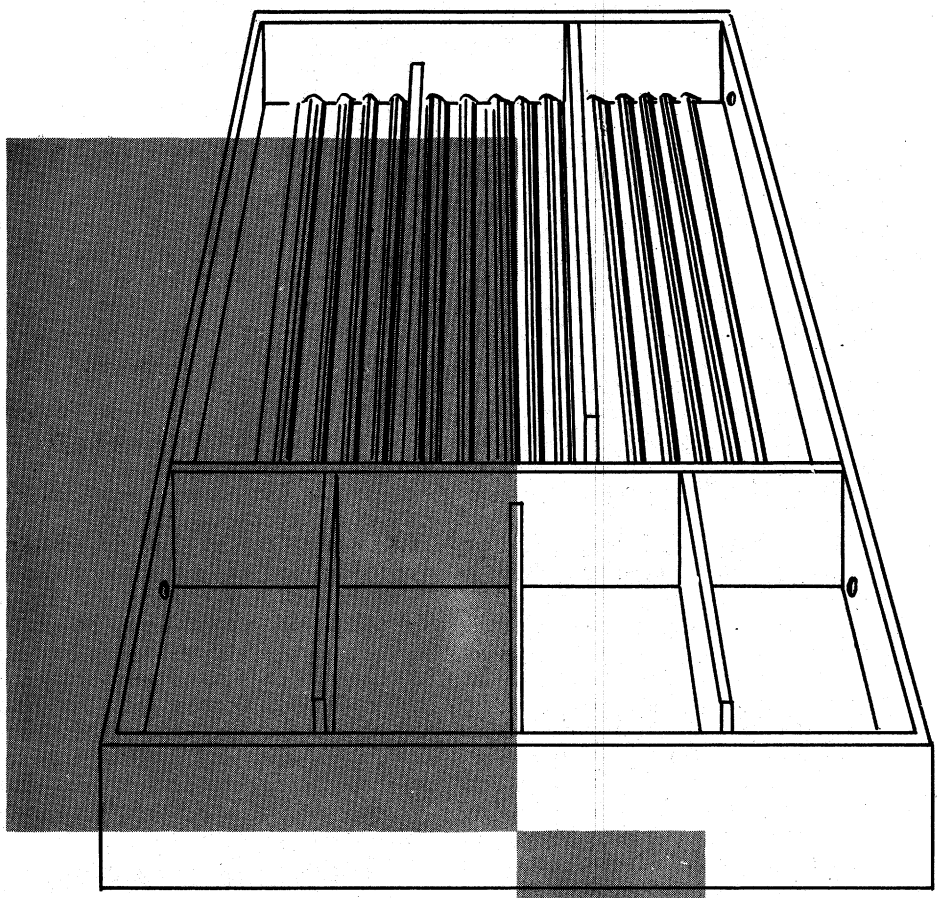

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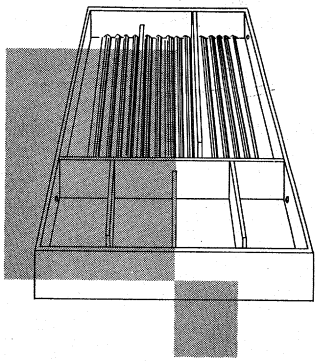
. . . how to remove it



SCALE IN MAPLE-SIRUP EVAPORATORS

. . . how to remove it

By J. C. UNDERWOOD and C. O. WILLITS, *Eastern Utilization Research and Development Division, Agricultural Research Service*

When maple sap is concentrated to sirup in a flue-type open-pan evaporator, the organic salts become supersaturated; that is, they are concentrated to a point where they can no longer be held in solution. They are then deposited on the sides and bottom of the evaporator as a precipitate, or scale. This scale forms a hard, impervious layer that builds up with continued use of the evaporator. By reducing heat-transfer efficiency, the scale causes waste of fuel and an undue holdup of sirup in the evaporator.

The scale is of two types. One type is a proteinlike material that forms in the flue or sap pans. The other, called sugar-sand scale, forms in the sirup or finishing pan. It is a calcium and magnesium salt deposit, similar to milkstone and boiler scale.

Sugar-sand scale is the more troublesome of the two types. It is especially troublesome if it is allowed to build up to an appreciable thickness. Also, sugar sand contains entrapped caramelized sugar, which contributes to the production of dark-colored sirup.

Removing sugar-sand scale is not easy, and doing it by physical means (scraping, scrubbing with steel brushes, or chiseling) is almost impossible. Removal becomes more difficult as the layer of scale becomes thicker.

METHODS USED IN THE PAST

Some methods producers have used in the past to prevent the formation of scale and to remove thin layers include:

(1) Pouring skim milk into the pan and letting it remain until it sours; the lactic acid of the sour milk has some solvent action on the scale.

(2) Running soft spring water through the evaporator for a long period; this tends to dissolve small amounts of scale.

(3) Reversing the flow of sap through the evaporator, according to the manufacturer's directions; this retards the formation of scale.

Equipment manufacturers have used muriatic acid to remove heavy incrustations of sugar-sand scale from evaporators returned to them by maple-sirup producers. This acid is highly corrosive and must be used with great care to avoid damaging the pans by dissolving away the thin tin-plate coating. Also, unless a person is experienced in the use of muriatic acid, there is danger that he will get the acid on other materials or on the skin.

CHEMICAL CLEANERS

Laboratory and field tests have shown that *sulfamic acid*, one of the chemicals developed for cleaning milk-processing equipment and marine boilers, can be used to remove sugar sand from most maple-sirup equipment. Sulfamic acid (the half amide of sulfuric acid) is an odorless, white, crystalline solid that is highly soluble in water. **It must not be confused with sulfuric acid.** Sulfamic-acid crystals can be han-

...ied easily, with little risk of spilling and little danger from volatile fumes. As a solid, sulfamic acid is reasonably harmless to the skin and clothing. However, a solution of the acid can cause skin irritation. **If either the dry acid or its solution comes into contact with the skin, it should be washed off immediately with large quantities of water.** Also, it should be removed from clothing and equipment by rinsing repeatedly with large quantities of water. Bulk supplies should be stored in a tight container in a dry place.

Despite its strong acid characteristics, sulfamic acid has only a slight corrosive action on most metals except zinc plating, especially if contact is of short duration. For example, on tin (the metal coating of most evaporators), hydrochloric acid is almost 25 times and sulfuric acid is approximately 80 times more corrosive than sulfamic acid. Furthermore, some manufacturers of sulfamic-acid cleaners add so-called inhibitors to the acid, which lessen its corrosive action and thus greatly reduce its attack on iron and steel. Usually sulfamic acid with inhibitors costs considerably more than the pure chemical. Whether or not purchase of the higher priced acid containing inhibitors is justified depends on the use to be made of the cleaner. Because of its corrosive action on zinc plating, sulfamic acid is not recommended for cleaning galvanized iron.

Gluconic acid, another chemical cleaner, is recommended for cleaning galvanized-iron equipment because it has much less corrosive action on the zinc coating. However, use of gluconic acid need not be limited to cleaning galvanized equipment; it is effective on most metals, even though it has a slower cleaning action than sulfamic acid. It is usually sold as a 50-percent water solution.

Both sulfamic acid and gluconic acid can be obtained from suppliers of maple-sirup equipment.

USE THESE AMOUNTS OF ACID

Sulfamic Acid

For a thin scale—Use ¼ pound (½ cup) per gallon of water. This is a 3-percent solution.

For a heavy deposit—Use ½ pound (1 cup) per gallon of water. This is a 6-percent solution.

Gluconic Acid

For all deposits—Use 1 gallon of 50-percent stock solution (obtained from your supplier) to each 4 gallons of water. This is a 10-percent solution.

To avoid damaging the tinned surface of the evaporator, do not use a stronger solution than recommended; and do not leave the solution in the evaporator longer than is required to soften the scale.

CLEANING PROCEDURE

Use the same methods to clean the flue (sap) pans and the sirup (finishing) pan.

You will need a good supply of piped water, so that you can use a hose to rinse the pans. If water is not available at the evaporator house, take the evaporator pans to a source of piped water.

You should wear rubberized gloves to protect your hands from the acid solution.

The best maintenance practice is to remove the sugar-sand scale between each run. The following procedure should keep the evaporator clean and bright.

Swab the acid-cleaning solution on the pans with a cloth; allow it to remain a few minutes; then thoroughly rinse the pans with water, to be sure the acid is completely removed.

If a layer of scale has accumulated on the evaporator, use the following procedure:

1. Remove all loose scale and dirt from the pan with a broom or brush. Then rinse the pan with a good stream of water from a hose.

2. Plug the outlets of the pan. If the outlets have threaded fittings, use metal screw plugs; otherwise, use wooden, cork, or rubber stoppers.

3. Fill the pan with water to the level to be descaled. Measure the water as you put it in the pan, and make a record of the number of gallons for future use. Also, make a record of the estimated volume of the pan.

4. Add the correct amount of acid to the water in the pan. Stir to help dissolve the acid.

5. Warm the solution in the pan to a temperature of 140° to 160° F. This hastens the rate at which it softens or dissolves the scale. After the warm solution has been in the pan for a short time—usually 15 to 20 minutes is enough—brush the sides and bottom of the evaporator with a fiber brush to speed up removal of the deposited sand.

6. When the evaporator is clean, drain the acid from the pan. Turn the pan on its side and flush it out with a stream of water. Repeat the water rinse 5 or 6 times, and allow the pan to drain between each flushing. Thorough rinsing is necessary to insure complete removal of the acid and its salts from the pan.

To remove a thin layer of scale with sulfamic acid requires a total of 30 to 35 minutes; to remove a thick layer requires from 60 to 90 minutes. With gluconic acid, about twice as much time is required.

- You can store the acid solution and re-use it a number of times. Do not store it in iron or galvanized containers; glass or earthenware containers are best.
- To economize on the amount of acid, use a smaller quantity of solution and tilt the pan first in one position and then in another until all the scale-covered surfaces have been soaked.
- Sulfamic acid and its salts are toxic to growing plants. For this reason, it makes an effective weedkiller. However, care should be taken not to discard the used acid solution where desirable plants may be damaged or killed.

Further information on maple-sirup production is given in Agriculture Handbook 134, Maple Sirup Producers Handbook. Copies are available on request from the United States Department of Agriculture, Washington 25, D. C.